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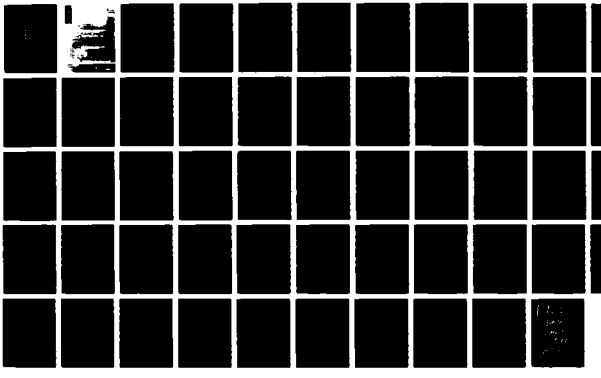

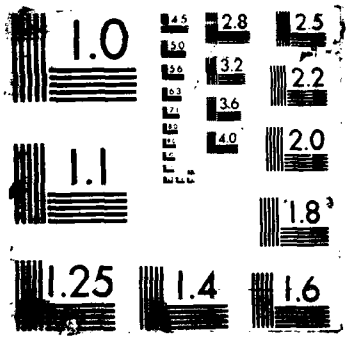
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SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER	2. GOVT ACCESSION NO.	3. RECIPIENT'S CATALOG NUMBER
4. TITLE (and Subtitle) The Soviet Union and Nuclear Proliferation: Policy at a Crossroads		5. TYPE OF REPORT & PERIOD COVERED Individual 6. PERFORMING ORG. REPORT NUMBER
7. AUTHOR(s) Randall L. Rigby, LTC		8. CONTRACT OR GRANT NUMBER(s)
9. PERFORMING ORGANIZATION NAME AND ADDRESS U.S. Army War College Carlisle Barracks, PA 17013-5050		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS
11. CONTROLLING OFFICE NAME AND ADDRESS		12. REPORT DATE 2 April 1988 13. NUMBER OF PAGES 61
14. MONITORING AGENCY NAME & ADDRESS(if different from Controlling Office)		15. SECURITY CLASS. (of this report) Unclassified 15a. DECLASSIFICATION/DOWNGRADING SCHEDULE

16. DISTRIBUTION STATEMENT (of this Report)

Approved for public release; distribution is unlimited.

17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)

18. SUPPLEMENTARY NOTES

19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

The Soviet Union has been a major participant of the regime of nations dedicated to limiting the spread of nuclear weapons. Since the early 1960's the Soviet Union has worked closely with the United States to limit nuclear proliferation. In no other area of international relations have the stated goals of the two superpowers been more closely aligned. Recent events indicate that the Soviet Union has parted from the original intent of the Nuclear Non-Proliferation Treaty and of the International Atomic Energy (con't)

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Association nuclear safeguards and has begun assisting nations that are not participants of the non-proliferation regime. While not specifically calling for a revision of the Nuclear Non-proliferation Treaty, the Soviet Union has unilaterally assisted in the spread of nuclear technology to nations that have refused to become members of the nuclear non-proliferation regime. This assistance is examined in the context of the overall Soviet nuclear thrust. Whether this is a sign of a change of Soviet nuclear non-proliferation policy or simply placing political goals above that of international agreements is examined. The paper concludes that the Soviet Union will use nuclear technology as a tool to further its strategic goals.

USAWC MILITARY STUDIES PROGRAM PAPER

THE SOVIET UNION AND NUCLEAR PROLIFERATION: POLICY AT A CROSSROADS

AN INDIVIDUAL STUDY PROJECT

by

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2 April, 1988

ABSTRACT

AUTHOR: RANDALL L. RIGBY, LTC, FA

TITLE: The Soviet Union and Nuclear Proliferation: Policy at a Crossroads

FORMAT: Individual Study Project

DATE: 2 April, 1988 PAGES: 58 CLASSIFICATION: Unclassified

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I: INTRODUCTION

The issue of nuclear proliferation has not occupied a place of prominence in the foreign policy affairs of the Soviet Union. Moscow's non-proliferation policy has largely been derived from the greater context of Soviet global politics, interests and policy formulation. At times the Kremlin's policy formulation in the area of nuclear non-proliferation has been extremely insightful; at other times, it has been transparently self-serving. In spite of its relative position in the hierarchy of interests, concerns, issues and foreign affairs, Soviet nuclear proliferation policy has nonetheless steadily grown closer to that of the United States. But nuclear proliferation among the many states now working to acquire nuclear weapons has the potential to radically change balance of power relationships, economic ties and security alliances as we know them. As these changes occur, the ability of the Soviet Union working alone, or in a regime of nations striving to control the nuclear proliferation will decline. Acquiring nuclear weapons tends to make nations independent.

It is clear that the proliferation of nuclear weapons is inevitable. If this is the case, what will the United States' chief adversary do to protect itself and its clients from the threat of nuclear proliferation? The historical record to date has shown that the transfer of nuclear technology, assistance

and material has a significant chance of leading directly to weapons development. This inquiry will examine the historical record of the Soviet Union in nuclear non-proliferation policy and actions. Also included will be an assessment of the current state of nuclear assistance provided to Soviet client states and non-aligned nations that conduct nuclear trade with the Soviets. This study is not a technical analysis nor is it a complete assessment of nuclear proliferation throughout the world. It is intended only to look at the history of the Soviet Union's nuclear non-proliferation policies and to examine the causes of Moscow's interest in the spread of nuclear technology.

BACKGROUND

In 1960, when only the United States, the Soviet Union, the United Kingdom and France had nuclear weapons, President Kennedy projected that in 20 years there would be between 15 and 20 nuclear weapon states in the world. Two years before, China had broken with the Soviet Union and declared it intended to develop its own nuclear weapons program. France had just detonated its first bomb in the Sahara desert. The size of the nuclear weapons club almost doubled between 1960 and 1964 when China eventually exploded its first nuclear device. Since 1964, however, there have been only two additional members added to the nuclear club, India and Israel, for a total of seven. India, with U. S. assistance, detonated a "peace weapon" in 1974.[1] Israel has never admitted having nuclear weapons, but it is widely accepted it developed a nuclear weapon capability in the early

1970's.[2]

Why was President Kennedy's prediction so wrong? What events happened to stop the spread of nuclear weapons at a time when it appeared to be a foregone conclusion? Are the conditions that have limited the proliferation of nuclear weapons since that time still valid today? Will they continue to work?

One answer is that, since Kennedy's prediction, the Soviet Union, in cooperation with other nuclear weapons states, has been a strong supporter of the regime of nations dedicated to limit the spread of nuclear weapons. This support was derived from an awareness that the spread of nuclear weapons posed direct threats to its own territory and population and to its client states. Adherence to this regime has been the cornerstone of Soviet non-proliferation policy for 18 years. In no other area of foreign affairs are the interests of the United States and the Soviet Union more closely aligned than in the area of limiting proliferation of nuclear weapons.[3] This interest is manifested in the provisions of the Nuclear Non-Proliferation Treaty and the International Atomic Energy Association's safeguards. Both superpowers agree that non-proliferation reflects the interests of every country, whether it is a nuclear power or not. Both understand the dangers of a nuclear proliferation and seek to deny, or at least to delay, the introduction of nuclear weapons to additional countries.

But the Soviet Union is becoming increasingly dependent on nuclear power to generate electricity for its expanding economy. While it is a staunch advocate for nuclear controls, the Soviet Unions is the worlds greatest proponent of plutonium producing breeder reactor technology.

There is legitimate concern that the current safeguard system will be inadequate in accounting for materials produced via widely distributed fast breeder reactors.[4]

The Soviet Union, like other nuclear powers, has evolved a nuclear non-proliferation policy in light of probable threats to its own security interests. While Moscow has defined a coherent policy that is in accordance with other nuclear powers, it has decided to expand its breeder reactor capability for future energy needs. In this sense Moscow is trying to "square a circle", that is, it wants to limit the spread of nuclear weapons while at the same time it is constructing plutonium producing breeder reactors inside the Soviet Union and is considering exporting them to other nations.[5]

II. SOVIET NUCLEAR PROLIFERATION POLICY

As a subset of the overall general foreign policy of the Soviet Union, nuclear proliferation policy has changed from time to time to meet the needs of the emerging Soviet nuclear state. In general terms, there have been three phases in the development of Soviet nuclear proliferation policy. The first phase includes the period in the 1940's and 1950's, from the time the Soviets first began working on a bomb until the ideological split with China; the second phase was in the 1960's as France and China gained nuclear status and the Soviet Union was faced with the possibility that West Germany would do the same. The third phase includes the 1970's to the present. During this time the Soviets have adopted the provisions of the Nuclear Non-Proliferation Treaty and have been an active participant in world nuclear non-proliferation institutions.[6]

PHASE ONE: ATOMS FOR PEACE

The Soviet Union's nuclear program began in 1942 when intelligence sources indicated that the United States (US)was working on a bomb. The urgency of the war with Germany precluded a full national undertaking in developing a bomb, although Soviet scientists worked on a bomb throughout the war. In the years immediately following the war, the Soviets offered proposals aimed at stopping other countries from obtaining nuclear weapons and limiting the nuclear arsenal of the United States. For example, Moscow rejected the provisions of the Baruch plan of 1946, which sought to place all nuclear resources under international ownership and control. The

Soviets were engaged in a propaganda battle and had no serious non-proloferation measures to offer as they struggled to gain a nuclear capability.[7]

The Soviet Union became the second nuclear weapon state in 1949, when it exploded its first bomb. From this time until the mid-1950's, there were no genuine proposals to limit nuclear proliferation or testing as it tried to close the apparent gap in nuclear weapons and delivery systems with the United States and the United Kingdom. The United Kingdom detonated an atom bomb in 1950, becoming the third nuclear state. It was during this period that the Soviets began to draw the distinction between those states with nuclear weapons, those states which posed a real threat to its security and those states which did not have this capability. This gave the Soviets the ability to prioritize potential opponents and to define the level of threat posed by the opponent.[8] To the Soviet Union those nations with nuclear weapons were a greater threat than those without nuclear weapons. The United States and the United Kingdom were nations with which the Soviets had a high level of concern. Others who were openly seeking weapons, such as France, were of concern but not to the same degree as states with weapons. Nations without nuclear capability or a desire to develop such a capability were not a strategic military concern.

THE CHINESE CONNECTION

The major distinguishing characteristic of this period, however, was the deteriorating relationship with China. For reasons that have never been

fully explained, it is believed the Soviet Union began sharing nuclear technology with the Chinese in 1955. While historians and scientists have debated the reasons for this assistance and the extent to which this led to the development of a nuclear weapons capability for China, there is little doubt that it was of great benefit to the Chinese.[9] The assistance came about as Moscow was attempting to get some sort of an "Atoms for Peace" program off the ground and, in all probability, the Chinese requests for peaceful nuclear assistance (among several other requests) was a way to implement such a program. A summary of what was transferred and the reasons for the transfer is as follows:

"Two things seem fairly certain about the unsafeguarded transfer of a 6.5 megawatt (Mw) reactor, and most likely also of a gaseous diffusion uranium enrichment plant to China between 1955 and 1958. The Soviet aid seems to have been part of a larger program designed to demonstrate political solidarity with friendly countries following a Council of Ministers declaration in January of 1955, that atomic aid would be forthcoming. And the Soviets' failure to apply safeguards seems part of a more general policy stemming from a sense of political control over the nuclear programs of allies, a lack realization on the part of Soviet officials that the material could be used so easily for weapons and that the Chinese might actually do so, and Khrushchev's willingness to accept the risks in trade for the political benefits gained. Significantly, the Soviets also failed to apply safeguards during this period to reactors promised to Egypt and Czechoslovakia."[10]

In early 1958, before the 6.5 (Mw) reactor was completed, the Chinese, upset because of a perceived unreliability of Soviet military aid and behavior which was objectionable to Mao, stated they intended to develop their own nuclear weapons. Although Soviet support in building the reactor

was suspended in the summer of 1958, the Chinese completed the construction and removed the enriched uranium, and in all probability, used the materials to produce the Chinese bomb.[11] Atmospheric tests conducted by the US following the detonation of the Chinese bomb in October, 1964, indicate that the nuclear material used was enriched uranium. All other weapons detonated to that date by the United States, the Soviet Union and the United Kingdom used plutonium as the fissionable material.[12]

A BITTER LESSON

It is probable the Soviet Union wanted to share its nuclear knowledge to increase the strength of its allies thereby increasing the overall strength of the alliance. Possibly the Soviets wanted, via nuclear cooperation with China, to establish a "Warsaw Pact" in the East.[13] The political rift, which gradually widened in 1958 and 1959, effectively ended that possibility as they saw control over the nuclear program in China slip away.

China was an embarrassment to the Soviet Union during this time. Mao was taunting the United States and firing on the Nationalists Chinese at Quemoy. Khrushchev, facing increasing Chinese independence, was powerless to prevent the confrontation. The Taiwan crises also threatened the credibility of the Soviet proposals on the Nuclear Test Ban proposed by the Moscow as a non-proliferation measure. In the mid-1950s the Soviet Union had resisted creation of the International Atomic Energy Agency (IAEA), which offered non-proliferation safety and accountability control measures by requiring member nations to account for all nuclear products

under the threat of international sanctions for noncompliance.[14] Because of the close ties between Moscow and Peking, the militancy of the Chinese toward the United States made the Kremlin appear to be similiarly confrontational. There is little question that the Soviet leadership learned a great deal from the experience with China in the late 1950s. Moscow had lost both political and military leverage and soon was surprised to find out how quickly the Chinese were able to turn the "Atoms for Peace" into nuclear weapons. Following the rift with China, Soviet nuclear export policies became much more conservative and certainly came with strings attached. Soviet policy also rapidly shifted to full support for the IAEA.

The Sino-Soviet split taught the Soviets about power in the international arena. From that time forward, the USSR has been much more careful in its dealings with other socialist states. With the lessening of political control, the accompanying loss of unsafeguarded nuclear material could be dangerous. After the split with China, the Soviet Union's policies regarding nuclear materials and technology were handled with caution and with more consideration to possible outcomes.

If the Soviet Union did give nuclear weapon information to China it learned that this would not be a good idea in the future. Since 1958, there is no evidence that the Kremlin has ever contributed to the development of nuclear weapons outside its own internal programs. In addition to stopping the nuclear assistance programs with China, many "Atoms for Peace" programs being carried out in the Eastern Bloc nations were curtailed and some were cancelled. Czechoslovakia was left with a half completed reactor and no further support from the Soviet Union until further nuclear policy decisions were made. It was not until 1972, that Czechoslovakia was

able to get its power reactor going and without external assistance it proved to be a costly investment.

In retrospect, it appears the Soviets were simply trying to pull the Chinese into the sphere of nuclear assistance with the hope of adding them to the long list of nations within the Soviet Bloc. The split with China caused Moscow to reassess its nuclear assistance policies. The Soviet Union's nuclear investments in China ended in the summer of 1958, and the last Chinese technician completed training at the Soviet nuclear facility at Dubna in 1960. Since that time there has been no more assistance from the Kremlin.

PHASE TWO: EACH WILL TAKE CARE OF ITS OWN

The second phase in the development of Soviet nuclear proliferation policy included the period 1960 through the signing of the Nuclear Non-Proliferation Treaty in1968. This period is notable because it represents a time in which the Kremlin began to demonstrate world leadership in the development of a comprehensive nuclear non-proliferation plan and began to work closely with other nuclear powers to construct a lasting non-proliferation arrangement.

Soviet nuclear proliferation policy took on larger dimensions in their overall foreign policy during this period as well. Two events are credited with the growth of the importance of nuclear non-proliferation issues in Soviet affairs. The first was the Cuban Missile Crisis of 1962. This crisis left both the United States and the Soviet Union with a deeper appreciation

of the other's position and need to cooperate with one another to avoid future confrontations. From that time on, the nuclear non-proliferation policy of both countries grew closer together until the signing of the Nuclear Non-proliferation Treaty in 1968. The second factor that contributed to the Soviet's interest in a stronger nuclear non-proliferation regime was the very real nuclear threat that a nuclear armed Multilateral Force would pose if created. Using nuclear non-proliferation as leverage, the Soviet Union offered to support the non-proliferation regieme if the Multilateral Force was cancelled. There was no doubt that the Kremlin did not want this force to come into being and significantly altered its non-proliferation stand to try to stop the creation of this force.

THE EXPANDING NUCLEAR CLUB AND THE PARTIAL TEST BAN TREATY

France became the fourth nuclear nation in 1960, when it detonated a bomb in the Sahara desert. Faced with the potential that China would do the same, the Soviet Union realized the nuclear threat was about to double and, at the rate of proliferation now taking place, its ability to control events would erode. Of even greater concern was the threat of a nuclear-armed West Germany. The U. S. conceived notion of the Multilateral Nuclear Force was designed to be under the control of several of the NATO member nations, one of whom was West Germany. As designed, the U. S. had veto control over the force therefore no proliferation was to be involved. But to the Soviet Union, the potential existed for West Germany to gain control of nuclear weapons. While some had predicted that it was inevitable that

France and China would become nuclear capable nations, the Soviet Union was determined to do something to stop West Germany from becoming a nuclear power.[15]

Kremlin policy abruptly changed at this time in order to seek conciliation with the United States and set out the provisions for the establishment of a treaty on testing nuclear weapons. Working closely together, the two superpowers finally came to terms on the Test Ban Treaty in 1963.

The significance of the 1963 Partial Test Ban Treaty cannot be understated in the examination of Soviet nuclear proliferation policy. Under the terms of this agreement each participating member would:

"Prohibit the carrying out of any nuclear weapon test explosion or any other nuclear explosion: (a) in the atmosphere, beyond its limits, including outer space, or under water, including territorial waters or high seas; or (b) in any other environment if such explosions causes radioactive debris to be present outside the territorial limits of the state under whose jurisdiction or control the explosion is conducted."[16]

This treaty, following the banning of nuclear weapons testing in the Antarctic in 1959, was a clear demonstration of Soviet intent to fully participate in the world arena to limit the spread of nuclear weapons. More importantly, Soviet foreign policy became more closely aligned with non-proliferation policy as the Kremlin compromised on nuclear testing in exchange for the cancellation of NATO plans for the nuclear equipped Multilateral Force. It was also a significant first step in the establishment

of a non-proliferation regime of nations.

NON-PROLIFERATION EFFECT IN EASTERN EUROPE

After the split with China the Soviet Union sharply cut back nuclear exports to East European nations. The agreements between Moscow and several Soviet Bloc nations including Czechoslovakia, East Germany, Poland, Rumania, Bulgaria and Hungary were reexamined during this period. The terms of the formal support agreements included not only technical assistance but also actual reactor units for several of these countries.

After 1958, Moscow slowed down the transfer of nuclear energy technology to these countries. Many of the commitments were cancelled outright, drawn out or simply left unfinished.[17] The reason, of course, was that the Soviet Union saw a direct relationship between the support for nuclear power generation and the production of nuclear weapons. The promised assistance to Czechoslovakia is a case in point. The Kremlin delayed direct technical assistance on the Czech A-1 reactor, "presumably because the natural uranium reactor's high plutonium productivity appeared in a different light after the Chinese experience."[18] These restrictions were such that the Czechs were not able to get their reactor on line until 1972. Other East European nations encountered the same difficulties.

Besides the curtailment of technical assistance, the Kremlin also instituted a policy whereby all nations receiving Soviet nuclear assistance had to obtain all nuclear fuel for the reactors from the USSR and had to return the spent fuel rods to the USSR. In this manner the Soviet Union was able to actively control the vital nuclear material component needed to

manufacture nuclear weapons. Similarly, Eastern Bloc nations have not been allowed to develop nuclear reprocessing and enrichment plants which could prepare uranium and plutonium for weapons, even if they had possession of the raw materials.[19] Czechoslovakia has the world's largest reserves of natural uranium but all of its nuclear fuel is produced in the USSR and the spent fuel rods are returned there after use.

These nuclear export restrictions served the Soviet Union's nuclear non-proliferation needs well in the 1960's. The spirit and intent of their nuclear proliferation policy was summed up by V.S. Emelyanov, Deputy Chairman of the Soviet Council of Ministers State Committee on the Utilization of Atomic Energy. In 1963, Emelyanov told a West German nuclear energy official that proliferation control would be easy if the rest of the nuclear nations would follow the Kremlin's example and "each take care of its own." It is clear the Moscow did take care of their own, and appeared to be unconcerned about proliferation outside the immediate bloc of nations under its control to the point where this became the de-facto Soviet nuclear non-proliferation policy.

PHASE THREE: TOWARDS A NON-PROLIFERATION REGIME

The third phase of the Soviet's nuclear non-proliferation policy is the period of time from the mid-1960s to the present. This period includes important measures taken by the Kremlin to insure strict controls of nuclear materials and technology and the recognition of the problems of other nuclear weapon states. Most importantly, it represents an admission

on the part of the Soviet Union that limiting nuclear proliferation amounts to more than each taking care of its own and that all major nuclear weapons powers have a responsibility to control the spread of nuclear weapons.

In 1961, the Irish delegation to the United Nations introduced a resolution before the General Assembly calling for the establishment of formal controls on the spread of nuclear weapons. While most nuclear powers recognized the importance of the resolution, each had its own particular set of measures it wanted included in the provisions of the treaty. The USSR, as a major power, quickly saw the potential benefits of an international league controlling the spread of nuclear weapons and adopted a position closely aligned with the United States and the United Kingdom. This treaty, known as the Treaty on the Non-Proliferation of Nuclear Weapons (NPT), was signed on 1 July, 1968, and entered into force on 5 March, 1970. The key provisions of the NPT:

> Prohibit the transfer by nuclear weapons states, to any recipient whatsoever, of nuclear weapons or other explosive devices or of control over them, as well as the assistance, encouragement or inducement of any non-nuclear weapon state to manufacture or otherwise acquire such weapons or devices.

> Prohibits the receipt of these materials or items by non-nuclear weapons states from any transferor whatsoever, as well as the manufacture or other acquisition by those states of nuclear weapons or other nuclear explosive devices.

› Non-nuclear weapon states undertake to conclude safeguard agreements with the International Atomic Energy Agency (IAEA) with a view to preventing diversion of nuclear energy from peaceful uses to nuclear weapons or other nuclear explosive devices.

› Member nations agree to facilitate the exchange of equipment, materials and scientific benefits from the peaceful applications of nuclear explosions which will be available to non-nuclear weapon parties to the Treaty.

› Nations with nuclear weapons also undertake to pursue negotiations in good faith on effective measures relating to cessation of the nuclear arms race at an early date and to nuclear disarmament.[20]

The thrust of the official Soviet non-proliferation policy today is reliance on the Nuclear Non-proliferztion Treaty. In addition to publicly advocating full support of the NPT the Soviet Union is also involved in supporting the provisions of the International Atomic Energy Association (IAEA), which accounts for the majority of the world's nuclear materials. The IAEA, which was really the only major accomplishment of the Atoms of Peace programs of the 1950's, was established in Vienna in 1957. This organization requires its member nations to file regular detailed reports on non-weapon nuclear activities and to allow international inspectors to visit nuclear facilities to verify the reports and to insure that there has been no

diversion of nuclear materials from peaceful to military purposes.[21]

SOVIET ADVOCACY FOR THE REGIME

In spite of the USSR's inability to come to grips with its own arms race with the US, it has long been an ardent supporter of the regime of nations in support of the NPT. With their full cooperation, this regime has successfully incorporated numerous regional, territorial and international understandings on nuclear weapons use and non-proliferation.[22]

The Kremlin uses every opportunity at hand to extol the virtues of the NPT and has worked to convince those non-signatories to sign the treaty and adopt the provisions of the IAEA safeguard system. Many articles on non-proliferation in Soviet writings include passages about the importance of the NPT. Their view of the NPT is summarized as:

"The Nonproliferation Treaty therefore reflects interests of all countries-large and small, nuclear and nonnuclear, developed and developing- and there is no alternative to the NPT in the contemporary world."[23]

In its official capacity as a nuclear weapon state and a member of the nonproliferation regime the Soviet Union has concluded that non-proliferation is more than simply taking care of its own. Soviet leadership in the non-proliferation regime has been critical to the success of the non-proliferation process. The Soviet Union's official support of the NPT represents one of the major international issues in which there is total agreement with the U. S. This agreement has been further highlighted by

the establishment of the Nuclear Suppliers Group following the detonation of a "peaceful bomb" by India in 1974. While some have criticized this organization for being a "secret cartel" at odds with the IAEA system and for holding secret meetings and not publishing the discussion topics, those that belong to the "London Club" hold that it has been singularly successful in eliminating a nuclear suppliers competition that could conceivably lead to another situation such as the India peace bomb.[24]

To overcome criticism, the Nuclear Suppliers Group has announced guidelines for all meetings. Among these include provisions for (a) the conditions under which safeguards of IAEA would be imposed, (b) restraint among the suppliers on sensitive transfers and (c) the establishment of consultations procedures if violations of safeguard measures occur.[25]

The Soviet Union is a major player in the activities of the London Suppliers Club. It actively support the organization and, as with other non-proliferation organizations, they requires Soviet Bloc nations to conform to the letter of each provision. Additionally, the Soviet Union and the United States meet regularly to discuss proliferation issues of common interest. These relatively low level meetings do much to contribute to the success of the non-proliferation regime.

III. THE PROLIFERATION THREAT

The heart of Soviet nonproliferation policy is a reliance on the provisions of the NPT and the IAEA safeguards to limit the nuclear threat to itself and its allies. The provisions of the NPT effectively negated the threat posed by West Germany and Japan. The net effect of the NPT has been beneficial to Soviet security and it remains a key element in Kremlin policy. But there are over 40 nations which still have not signed the NPT and adopted the provisions of the IAEA safeguard system. Several of these nations have economic and technological bases that are large enough to permit them to build nuclear weapons if the political decision to do so is made. Others do not have the technical base or the economic strength to start a weapons development program but would like to possess nuclear weapons. Collectively, these nations can be classified as either those having a moderate motivation to acquire nuclear weapons: Argentina, Brazil, Chile, Egypt, Iran, South Korea and Taiwan and, those with high motivation to acquire nuclear weapons, Iraq, Libya, Pakistan and South Africa.[26] Of these, Pakistan and South Africa are probably the greatest threat to the USSR.[27]

Another way to assess the threat to Soviet security is to arrange potential nuclear proliferators into regional clusters. These clusters include Europe, the Middle East, South Asia, North East Asia, South Africa and Latin America. Four of these clusters are along the Soviet border: Europe, The Middle East, South Asia, and North East Asia. If the nations in these clusters were to acquire nuclear weapons, the USSR would be "ringed

by nuclear powers."[28] Because many of these are not allied with the Soviet Union there is no doubt the Kremlin would move to counter this risk.

The possibility of a ring of nuclear armed nations around the Soviet Union is unlikely. The provisions of the NPT make it the single most important non-proliferation tool the Soviet Union has in preventing such an eventuality. But the question remains: What would the Soviets do to offset the potential effects of nuclear proliferation in their back yard? While the probability of a nuclear confrontation with the United States has been discounted by both the Soviet Union and the United States, both sides admit that further proliferation risks could cause destabilization of current power alliances and upset the balance of power.

Particularly worrisome is the possibility of a catalytic nuclear event which could conceivably involve one or more of the superpowers if it was felt vital interests were at stake. While both sides have worked to preclude such an occurrence, nuclear proliferation in the Third World during the past three or four years has caused much uneasiness on both sides. It is likely that the two superpowers will have to work even more closely together in the coming years if the spread of nuclear weapons is to be curtailed.

The list of possible nuclear threats, the combinations and permutations and the relative risks associated with each are well beyond the scope of this paper and would serve little purpose. However, recent nuclear proliferation in nations bordering the Soviet Union are a significant security problem for Moscow and are worth examination for three reasons. First, a Soviet response to stop or limit proliferation (or the absence of a response) in a particular region could very well define the extent to which nuclear

proliferation will grow in the area for years to come. For example, Israel's 1981 attack on the Iraqi Osiraq research reactor destroyed the cornerstone of that nation's bid to gain nuclear weapon status. As a result Iraq has had no nuclear program since that time and will not have one for the forseeable future. A similar move on the part of the USSR in , Pakistan for example, would have far reaching international consequences Secondly, a growing number of economists are becoming interested in nuclear proliferation as an indicator of increasing economic strength. There are signs that increased economic prestige is among the incentives that drive the near nuclear nations toward attaining weapons status even though the cost of developing nuclear weapons is very high. Pakistan's Prime Minister has repeatedly stated his people would "eat grass" in order to acquire nuclear weapons. Third, limiting the spread of nuclear weapons to non-weapon countries has been a mutual interest of the US and the USSR for over a quarter of a century. Any shift in the Kremlin's restrictive attitude toward proliferation would upset this accord and could have far reaching arms control implications. Accordingly, the Soviet Union's interests, potential threats and likely responses in the regions listed are as follows:

EUROPE

Any further nuclear proliferation in Europe would directly threaten the security interests of the Soviet Union. The direct threat is to the Soviet mainland, its satellite states and the populations, military forces and economic enterprises of the Soviet bloc. That the Soviet Union considers

this area to be the most sensitive area as far as nuclear proliferation is concerned can be deduced from the rapid policy change on the part of the Kremlin in the 1960's when it felt it could be threatened by a nuclear armed West Germany via the Multilateral Force. Faced with this possibility, Moscow quickly joined with the United States and other nuclear weapon states and pushed for adoption of the NPT. With the signing of the NPT, West Germany and the Multilateral Force was no longer a nuclear threat to the Kremlin. In compliance with the provisions of the NPT, the Soviet Union pressured each of its bloc states to also ratify the NPT. The result has been the removal of West Germany as a nuclear threat and a slow introduction of nuclear energy in East Europe. [29]

FRANCE

France remains the single nuclear weapons state in Europe that has not ratified the NPT. Through diplomatic and IAEA ties, the Soviet Union, along with the United States, moniters the nuclear trade of France with other nations. In the event of war, France would be a threat to the Soviets ability to project power. France also has a sizeable nuclear inventory and an advanced delivery capability. Accordingly, France could be a threat to the Soviet Union and its allies in the event of war.

EUROPEAN STABILITY AND THE NPT

As a whole, the NPT has stabilized the balance of nuclear power in

Europe to the satisfaction of the Soviets. The Soviet Union, working in its own interests, has cooperated with other nations in limiting the spread of nuclear weapons in the region. Although the USSR has continued to build both conventional and nuclear forces in Eastern Europe, most consider the likelihood of major conflict in the region to be low. Barring unforseen events, the Soviet interests in Europe are to maintain this balance with NATO, and to continue to negotiate to reduce nuclear stockpiles in arms control agreements. The outcome of the INF Treaty process will have an impact on nuclear non-proliferation. Under the terms of the INF agreement, the US and USSR agreed to reduce the number of warheads and missiles. This is the first negotiated nuclear warhead reduction in history. If for any reason the INF accords are not fulfilled, the non-nuclear nations, particularly those with a high motivation to acquire nuclear weapons, will be hard to control in terms of nuclear non-proliferation because they will see the US and the USSR as failing to live up to the terms of the NPT. The INF Treaty is much more than a regional disarmament issue.

THE MIDDLE EAST

Clandestine nuclear proliferation is the greatest single threat to Soviet security. Israel's secret weapons development program is of the highest concern to the Kremlin. Although Israel has never tested nuclear weapons, virtually all sources now believe that Israel has developed a considerable nuclear stockpile.[30] In the event of hostilities a nuclear equipped Israel is a real threat to Moscow's ability to project power into the region. Israel also directly confronts Soviet client states in the area, principally Iraq,

Libya and Syria. These states have a high interest in attaining nuclear weapons and have actively sought to gain a weapons capability.

IRAN

Recent reports indicate Iran's nuclear program was farther along than originally believed. The Shah of Iran had intentions to begin sophisticated nuclear research prior to his fall in the late 1970's. The Khomeini regime which inherited the Shah's nuclear investments has had little success in further progress because both the West German and French suppliers show little interest in further development of the research reactors at Bushehr and Darkhouin while the Iranians are at war with Iraq. A small U. S. built research reactor at Tehran has remained active under the current regime. The technology and materials of this project remain under IAEA controls.[31]

LIBYA

Libya, under Khadafi, has made no secret of its interest in obtaining nuclear weapons. Because of Khadafi's militancy, he has made little progress in gaining support for his intentions from any of the nuclear suppliers. In 1983, the United States stopped training Libyan citizens and the Soviet Union has noticeably slowed its earlier technical support of two power reactors for Khadafi. Pressure from the United States has also caused Belgium to withdraw from a billion dollar deal with Libya which would have offset the slowdown in nuclear trade with the Kremlin. That the

Soviets did not publically comment on this cancellation is a sign that they had little interest in supporting Libyan efforts to increase nuclear potential. Accordingly, Khadafi turned to Argentina and Brazil for nuclear technical assistance and support. The April, 1986, raid on Tripoil by the U.S. appears to have cooled this relationship as well. For the near term, Khadafi's hope to gain nuclear weapons status is in doubt. The Soviet Union and the United States will, in all probability, cooperate to limit further proliferation to Libya as long as Khadafi remains in power.

SYRIA

Syria has asked for direct Soviet nuclear weapons support if itwere subjected to an Israeli nuclear attack. While the Soviets have not publically replied to the request, the Syrians have given an indication the USSR would honor the request if Syria was subjected to an Israeli nuclear attack. That the Soviet Union would support such a request is an indication of the extent to which they view the strategic importance of the region, but this would be the least desirable course of action. Nonetheless, Syria is the Soviet Union's strongest supporter in the Middle East and it is in the interests of the Kremlin to keep the relationship viable.

A MOST UNSTABLE AREA

For the Soviets the most disturbing aspect of the proliferation issue in the Middle East is the volitility of the region. In addition to the constant

low intensity warfare and occansional large scale hostilities, at least five separate attacks on nuclear installations are known to have occurred. These include an unsuccessful raid by Iranian bombers on Iraq's Osiraq reactor in Baghdad on 30 September, 1980; an Israeli attack on the same reactor on 7 June, 1981, which completely destroyed the plant; and Iraqi attacks on Iranian power plants at Bushehr on 24 March, 1984, and subsequent raids on 12 February and 4 March, 1985. At the August, 1986, meeting of the Non-Aligned Movement, Khadafi renewed his threat to destroy the Israeli Dimona nuclear complex and denounced Egypt and Jordan for denying Libyan use of air bases for such an attack.[31] The introduction of nuclear facilities has been a destabilizing factor in the area as each faction attempts to counter the potential advantage brought on by the possibility of having a nuclear capability. *Unprecedented harm could occur if a successful attack were* made on an existing reactor releasing large volumes of concentrated radioactive materials into the atmosphere and contaminating the densly populated area.

The Middle East region, so critical to the security interests of both East and West, will remain a major proliferation problem area for the Soviet Union. The extreme emotion, tied to the long history and tradition of warfare in the region, does not portend well for any power to be able to exert control for some time to come. While the Soviet Union has strong ties with several nations in the area, including Iraq, Syria and Lybia, it is clear that it is not committed to introducing nuclear weapons beyond the extent to which Israel has put them in place. Although the current balance of power is not favorable to the Kremlin there is little it can do to offset the

imbalance without risk of provoking Israel, which will strike if security interests are threatened. If hostilities broke out the Soviet Union would be pressed by its client states in the region to provide assistance to meet security needs. This would be like throwing gasoline on a fire and the Soviet Union can be expected to go to great lengths to avoid having to do that in the foreseeable future.

SOUTH ASIA

INDIA

Nuclear proliferation has been a growing problem in southern Asia since the Chinese detonated their bomb in 1964. Continuing border disputes with India during this period, punctuated by the Chinese defeat of the Indian Army in a major clash in 1962, stiffened Indian resolve to develop nuclear "devices". Initially assisted by U.S. technicians as early as the 1950's, and later by Canada, India succeeded in detonating a "peaceful nuclear bomb" in 1974, thus becoming the sixth nuclear weapons nation.[33] There is considerable speculation that the Prime Minister at the time, Indira Gandhi, decided to develop the bomb as a political symbol to enhance India's image in the international arena rather than to begin building a military capability that would potentially threaten China. The result has certainly been international in that it has affected both US and Soviet nuclear policy.

For one thing, all U.S. nuclear assistance for India stopped immediately after 1974. Several nuclear projects underway, including power and research reactors were left unsupported. Seizing the opportunity, the

Soviets moved in quickly to fill in the void left when the U. S. pulled out. In a gesture of good faith, the Soviets agreed to supply 240 tons of heavy water to India. While, initially this appeared to violate the intent of the newly formed Nuclear Suppliers Group, it eventually came to light that the Soviets had caused the Indians to agree, in principal, to IAEA safeguards to the nuclear installation for which it was intended prior to the completion of the shipment.[34] This support arrangement has stayed in effect since 1976. Unfortunately, it applies only to those facilities supported by the Soviets and other NPT members. The remainder of India's nuclear facilities remain unsafeguarded. In spite of this, Soviet nuclear assistance has continued on to the present. Soviet nuclear assistance to India is apparently not linked to the requirement to be a member of the NPT regime. The Kremlin's interest in India is strong enough to cause it to compromise on safeguard requirements.

Moscow recently announced that India would be receiving a nuclear powered submarine under a lease agreement so that "the Indian Navy can acquire experience of operating this kind of vessel".[35] Although there would be no missiles or mockups of missiles, assistance of this type can only be viewed as questionable in the effort to limit nuclear proliferation. One can hardly imagine that the Indian Navy is developing a "peaceful nuclear submarine."

Whether by pressure from the Soviet Union or by other design, the Indian government has not begun a full weapons production program, although such and undertaking is easily within their grasp. Until her assassination in 1984, Mrs. Gandhi steadily built up India's capacity to produce nuclear

weapons from the installations in that country not under safeguards. Rajiv Gandhi, who succeeded his mother as Prime Minister, has kept these key installations from the safeguard system, thus making them the backbone of India's nuclear weapons potential.[36] By 1986, India was believed to have developed the capability to produce plutonium that is free of safeguard controls and available for use in nuclear weapons.[37]

PAKISTAN

Another direct result of India's detonation of the bomb in 1974 has been the emergence of Pakistan as a nuclear state. Pakistan has also developed a nuclear program that most observers now believe has reached the nuclear threshold stage of having all the components available but has not actually assembled or tested a bomb.[38]

Following the devastating defeat of Pakistani forces and the separation of Bangladesh from what was then East Pakistan, the then Prime Minister, Zulfikar Ali Bhutto, set out on a course to build a bomb to counter India's overwhelming conventional forces and to meet the then emerging Indian potential for developing nucelar weapons. Intially assisted by the French, later by the United States and Canada, and finally by the Dutch, they succeeded in building a heavy water power reactor and reportedly have acquired a uranium conversion capability along with an enrichment facility.[39]

Efforts to slow or stop the growing Pakistani threat in the region have been hampered by the Soviet support of India and recent U. S. support of Pakistan. As long as the Kremlin uses India as leverage against China and

Pakistan and the United States uses Pakistan as leverage against India and Afghanistan, there will be no resolution. In the meanwhile, the Pakinstan government will go on developing a weapons capability.

AN AREA OF RAPID PROLIFERATION

The dilemma faced by the Soviets in South Asia in their efforts to slow the spread of nuclear weapons is unlikely to be resolved in the short term. In the next few years, if not already, it is likely that the Kremlin will have nuclear armed neighbors in China, India and Pakistan. Some promise of stability could be forthcoming as rational, responsible governments grasp the dimension of the nuclear dilemma in the region. As a deterrent, nuclear proliferation may also stabilize this historically volatile region and cause the area's occupants to work more closely together. This eventuality is about all Moscow has to hope for. Relations with Pakistan have significantly cooled since the invasion of Afghanistan and the United States has warned the Soviets after the Soviet threat to Pakistan for supporting the Afghan rebels.

NORTH EAST ASIA

Proliferation in North East Asia has not expanded to the extent that it has in the Middle East and South Asia. However, there are proliferation dangers present in the area. The continuing problems between two Koreas and China and Taiwan are potential trouble spots for the Soviets. For the

long term, the Kremlin is keeping an eye on Japan as that economy continues to expand and dominate the area. Even more troubling is the forecast that in 20 years, Japan will have the third largest defense budget in the world.[40] With the possibility of economic confrontation with nuclear armed China, the provisions forbidding the development of nuclear weapons in Japan could be amended. The Japanese currently have a sizable uranium processing and enriching capability, and the technical capacity to construct nuclear weapons is certainly at hand. The threshold for Japan's decision to begin nuclear development appears to be other states in the region. If Taiwan or the Koreas were to begin a nuclear weapons development program, public opposition to the development of weapons would undoubtedly drop. This possibility would directly threaten the Soviet mainland and the Kermlin's projection of power capability in the region.

Accordingly, Moscow recognize the long term consequences of proliferation in the area and has worked to limit further spread. The most significant Soviet accomplishment has been the ratification of the NPT by North Korea in December, 1985. It is believed that the Soviets pressured the North Koreans into signing the accords as a result of urging by the United States. Some time in the early 1980's Washington became concerned about the unsafeguarded research reactor the North Koreans were building at Yong Byon. Because it was unusually large for an emerging nuclear state and because it was so well suited for nuclear weapons development, the Soviets and the Americans agreed it could have constituted a proliferation risk. In exchange, the Soviets have agreed to supply the North Koreans with a safeguarded commercial power reactor. This action has apparently cooled South Korean apprehensions about backing out of the NPT treaty, which it

signed in 1976.[41]

Taiwan has not shown any indication that it wanted to develop nuclear weapons since it stopped a small research program in the early 1970's. Apparently, Unites States' security guarantees and conventional arms and technical assistance are sufficient for Taiwan defense needs for the present. Again, the Taiwan government feels no need to develop a nuclear capability as long as the regional nuclear arms capability remains balanced.

China is the major proliferation risk in the area for the Soviets and poses significant risks for the world at large. China has been known as a major supplier of nuclear technical assistance and materials. Earlier in this decade there were reports that the Chinese were supplying nuclear assistance to South Africa, India, Argentina and Pakistan. However, in 1984, China joined the IAEA and announced it would require IAEA safeguards on its nuclear exports. This was probably done in exchange for U.S. arms and technology assistance.[42] Whatever the reason, the move has stabilized the region in terms of nuclear proliferation and slowed the development of nuclear weapons and facilities all over the world.

OTHER AREAS OF PROLIFERATION

In addition to the regional clusters around the Soviet Union, Moscow is also concerned with nuclear proliferation in Cuba, Argentina and South Africa.

Cuba is receiving support from the Soviet Union in its effort to build a nuclear power plant. The Kremlin agreed to supply Cuba with a reactor and

materials as far back as 1976, but Castro's steadfast refusal to sign the NPT has slowed up the construction. Cuba did agree to correspond with the requirements of the IAEA accords, but to date, it has not signed the NPT. In spite of this, the Soviet Union has begun the support necessary for Cuba to have a reactor capability. Again, as in the case of India, Soviet interests in the region are so strong that Moscow is willing to compromise the NPT in order to satisfy Cuba's requests for nuclear assistance.[43]

In 1980, Argentina entered into a nuclear support agreement with the Soviet Union. Under the terms of the agreement, the Soviet Union would supply five tons of heavy water, a machine for shaping fuel rods, the manufacture of 4,000 tons of fuel in the Soviet Union for shipment to Argentina and other add on agreements for nuclear support. The important thing about this support arrangement is that Argentina is not a signatory of the NPT nor does it subscribe to the provisions of the IAEA safeguards. As in the case of India and Cuba, Soviet interests in the region are strong enough to cause Moscow to provide nuclear supplies and assistance without safeguard assurances. It is clear the Kremlin does not consider Argentina a proliferation risk or a threat to Soviet security.[44]

The Soviet Union is concerned about the risks of nuclear proliferation in South Africa. Since 1985, is has been rumored that South Africa has significantly added to its nuclear stockpile, but is not inclined to test nuclear weapons because Pretoria does not want to risk straining relations with the West. South Africa has recently adopted the safeguard provisions of IAEA and is being monitored by both the Soviet Union and the United States. The Kremlin's interest here is controlling South Africa's ability to

disrupt Soviet power projection in Africa and South America. Political instability in South Africa could also result in a radical faction gaining access to nuclear weapons and attempting to further its political aims.[45]

IV: SOVIET RELIANCE ON BREEDER REACTORS

Soon after the NPT was signed by the United States and the Soviet Union, the Kremlin began exporting nuclear technology. Three events of the early 1970's combined to cause the Soviet Union to undermine the non-proliferation regime: (1) the 1973 oil crisis; (2) the May, 1974, Indian nuclear explosion; and (3) the recognition that Moscow could become a sizable force in the construction of reprocessing and enrichment facilities.[46]

A PLUTONIUM ECONOMY

The Soviet Union quickly realized the strategic significance of the oil crisis in 1973. It determined that the growing world demand for fossil fuels would eventually outpace the available supply. Soviet strategic oil reserves were sufficient for the short term, but the long term outlook was not good and the oil crises only highlighted the potential future for the Soviet economy. Moscow recognized the vulnerability of industrial nations and began a program of expanding nuclear technology to overcome the future energy shortfall. The explosion of the Indian bomb only pointed out the shortcomings of the non-proliferation regime in dealing with emerging Third World nations desiring independent economies.

THE SOVIET NUCLEAR THRUST

Thus began what is known as the Soviets' nuclear thrust which is a product of many economic and political considerations. Simply stated, the Soviet nuclear thrust is the support of the development of nuclear power, principally in the Third World, and exploiting the indecisiveness of the Western nuclear powers to come to grips with the issue of nuclear commodities.[47]

Two examples will illustrate this point. The first is the willingness to supply India with heavy water after the United States had stopped all nuclear materials and technological support following the Indian bomb in 1974. The second is the case in which prior to 1974, 100% of all nuclear enrichment services were provided to European nations by the United States. In 1974, the U.S. placed these services on conditional status until the U.S. domestic needs could be determined in the wake of the Indian bomb. Left lingering, the European nations turned to the Soviet Union for assistance as the Soviets were the only other nation with an established nuclear enrichment service.[48] Since that time the Soviet Union has become a world leader in enrichment and refinement of nuclear fuels. Contracts for nuclear fuel supply have been established with Finland, The Philippines, Libya, Cuba, Brazil, Iran, South Africa, Pakistan, South Korea and Argentina.

More troubling still is the reliance on fast breeder reactors to meet the energy demands of the future. Again, the Soviet Union differs significantly with the United States on this point. Apparently the Kremlin feels that, like fossil fuels, there is only a finite amount of uranium fuel availiable. At some point in the future the supply of the world's uranium will reach some crisis point, just as the shortage of fossil fuels led to the 1973 oil crisis.

The Kremlin's answer is the breeder reactor, which produces up to 100 times as much nuclear fuel as it uses. It also produces plutonium which is the fuel of choice in nuclear weapons. Currently the Soviet Union has four breeder reactor plants, the first of which began full capacity operations in 1968. The Soviets have not exported a breeder reactor outside of the country, but they have breeder reactor technical agreements with Japan, France and Czechoslovakia. Recent nuclear accidents have caused a slowdown in the Soviet Union's nuclear thrust. The future of fast breeder reactors is uncertain until the considerable technical problems are resolved.

For the time being it is likely the Soviets will continue to selectively demand adherence to the NPT and continue to argue for strict controls over non-signatories. The hard part for the Soviet Union will be to maintain the relationships they have established via nuclear trade while expanding the breeder reactor thrust. It is clear the USSR is devoted to the breeder reactor program and see this as the long term solution to energy needs of the future. Just how it will handle the increasing demands of their client states remains to be seen. Moscow cannot continue to meet the intent of the NPT and at the same time expand its nuclear economy to countries outside the Soviet Union without dangerously risking increased nuclear proliferation.

V: CONCLUSION

Florence Nightingale once observed that whatever hospitals do they should not spread disease. A nuclear nonproliferation regime should have basically the same orientation with respect to nuclear materials, technology and weapons. Any organization with a stated purpose should work steadfastly to achieve that purpose. But the political reality for the Soviet Union is that while it is to its advantage to belong to the non-proliferation regime, the full commitment itself is difficult. In the past few years the divergence of the Soviet Union from the provisions of the NPT and the IAEA safeguard system indicates there may be a change in its non-proliferation policy.

AN EXPEDIENT OR NECESSITY?

Some observers have concluded that the policy change has already occurred. The key feature of this change in nuclear proliferation policy is the introduction of politics into the international non-proliferation arena. In general terms, the Soviet Union has placed its political interests above the provisions of the Nuclear Non-proliferation Treaty and the IAEA safeguards. This "primacy of politics" was first introduced when the Soviet Union quickly moved into India following the United States' withdrawal in 1974, providing the Indian government unsafeguarded heavy water. Since

that time the Soviet Union has similarly provided materials for nuclear reactors in Argentina and Cuba. None of these nations have ratified the NPT; Cuba was one of four nations to vote against the treaty before the United Nations General Assembly while the Soviet Union was a co-sponsor of the initial resolution.[49]

The increased nuclear trade with nations that are not party to the provisions of the Nuclear Non-proliferation Treaty is a major step on the part of the Soviet Union and opens the overall Soviet intent to question. In the first place, it is a point of contention with the United States. Unilateral nuclear trade on the part of the Soviet Union caused a breakdown of bilateral talks with the United States during the latter part of the Carter administration. These talks were resumed in 1982 under President Reagan.

Also many Third World nations have criticized the treaty on the grounds that it is an example of the "haves" withholding from the "have nots". The increased trade initiatives to Libya, Cuba, Argentina and India may be a part of an overall Soviet effort to uphold their revolutionary image. Moscow's motives could be a component of any one of three possible explanations. The first is that the Soviet Union has gained increased confidence in its ability to control client states and could limit nuclear weapons development if necessary. The second possible explanation is that the Soviet Union's increased nuclear trade is necessary because of political or economic reasons. With the number of nuclear suppliers growing, the Soviets may feel that if they do not provide the requested materials, someone else will. Third, the increased nuclear trade may be a product of internal bureaucratic conflicts with one element of the government not being in concert with the intentions of the other.

It is likely that the reasons for the Kremlin's increased nuclear trade with nations that are not party to the NPT is a combination of all of these elements. The political and economic necessity of increased nuclear trade is probably the most potent of the factors but the others contribute as well.

Over the years the Soviet Union has learned to distinguish between the quality and quantity of the threat to its security. From Moscow's perspective these threats are mounting on the country's periphery. While it has historically been in the interest of the Soviet Union to work to stop nuclear proliferation, the potential threat now has caused them to reexamine existing nuclear trade agreements in the context of overall security measures and agreements. They have found that nuclear technology can buy them a foothold advantage to counter the larger threat. To use nuclear technology as a bargaining chip is more or less in accord with their overall nuclear thrust, that is, it is part of their long range energy independence goals.

The Soviet Union also feels it can control the nuclear client states, using nuclear supply as a leverage. In this respect it is playing both ends against the middle. While Moscow conducts nuclear trade with nations that do not participate in safeguard accords, it uses the safeguard measures to control these nations by having the nuclear materials recycled through the Soviet Union.

At the same time the Soviet Union is attempting to gain a strategic foothold in Cuba, Libya, Argentina and India. Churchill once said that the key to understanding the Soviet Union is to examine its interests. While Soviet behavior, the ways and means, is often contradictory, the ends are constant.

In this sense, the Soviets nuclear nonproliferation behavior can be seen as dynamic, being changed to meet the existing political reality and being used as an instrument in their foreign policy initiatives. Soviet nuclear nonproliferation policy is a subset of the overall Soviet foreign policy agenda. The Soviet Union will use nuclear technology as a foreign policy tool if the benefits to their security outweigh the risks. At the same time Moscow is upping the ante on nuclear proliferation and betting they can keep proliferation of nuclear weapons under control.

APPENDIX A: CREATION OF FISSILE MATERIAL*

*This appendix is extracted from The Arms Control Reporter, 1986, p602.E.3.

One fissile material exists in nature: U-235, which makes up .7% of natural uranium - the remainder is U - 238. Bombs usually use 90% fissile or so-called special nuclear material (SNM). Ordinarily either uranium is enriched to increase the percentage of U - 235, or U - 238 is transformed into man made plutonium Pu - 239.

Transformation of U - 238 occurs in a reactor when U - 238 absorbs a neutron during a controlled fission chain reaction, becoming U - 239 which is then transmuted by radioactive decay to Pu - 239.

To understand how fissile materials may be obtained for a bomb, one must understand the nuclear fuel cycle and its opportunities for obtaining weapon - grade material: (a) enriched uranium from an enrichment facility, (b) clandestine production of Pu - 239 in a commercial facility, or (c) open production in a dedicated reactor, as takes place in the United States military production reactors.

The nuclear fuel cycle begins with the mining of uranium ore. After mining, milling removes the host rock, leaving what is known as yellowcake, U_3O_8.

The yellowcake is converted into either uranium dioxide, UO_2, for direct use in heavy water reactors (HWR) or into uranium hexaflouride, UF_6, for enrichment for light water reactors (LWR).

Enrichment of uranium from .7% to 1 - 5%, required for LWRs. may be done in four ways: gaseous diffusion, gas centrifuge, aerodynamic, and laser

isotope separation. The first three are very expensive, especially when trying to reach the 90% enrichment required for SNM. aerodynamic and laser isotope processes remain in the experimental stage. Once developed, laser enrichment might be very cheap, because comparatively little energy is used.

Fabrication of the fuel into small ceramic pellets of UO_2 and placement on long fuel rods is usually required. the rods are assembled into a bundle before being used in a power plant.

Light water reactors may be either boiling water reactors or pressurized water reactors. These use normal water as the moderator (substance between the fuel rods) which slows the speed of neutrons (enroute between rods), hence increasing their chance of contributing to the fission reaction.

The drawbacks of LWRs include the fact that their fuel must be enriched to 3% U - 235, and they require a complete 4 to 6 week shutdown to refuel. The spent fuel from a LWR can be reprocessed or stored.

Heavy water reactors use a moderator heavy water, D_2O, instead of water H_2O. D is deuterium, a hydrogen atom to which one neutron has been added. Heavy water does not slow neutrons as well, but it absorbs far fewer of them. Because more neutrons hit fuel rods, the reactor can use natural uranium, saving the expense of enrichment.

Refueling of most HWRs can be done continuously because fuel rods sit in individual pressurized tubes instead of one large vessel, permitting on - line refueling. Upon removal from the core, irradiated fuel can be either reprocessed, or stored in pools to await permanent waste disposal.

The best known HWR are designed in Canada and named CANDU: Canadian Deuterium Uranium Reactors.

HWRs and LWRs consume more material than they produce, they are burners of fissile material rather than breeders.

Reprocessing of fuel from either a HWR or a LWR employs the PUREX (plutonium and uranium recovery by extraction) process which begins with the chopping of spent fuel rods and the dissolution of the mixture in nitric

acid. further chemical separation removes the usable plutonium and uranium for fuel fabrication or bomb construction. At present uranium prices, the cost of reprocessing makes reprocessing solely for power plant fuel unprofitable.

No simple way now exists to separate the different isotopes of plutonium. Consequently the grade of plutonium is fixed when it emerges from the reactor. To produce weapon grade plutonium, a normal commercial reactor must be operated abnormally.

APPENDIX B: CREATION OF A FISSION BOMB*

*This appendix is extracted from The Arms Control Reporter, 1986, p602.E.1

A fission bomb employs energy released when a free neutron strikes the nucleus of an atom of fissile material, splitting the nucleus.

The result of the splitting of fissile nuclei is on average 2 - 3 neutrons, 2 lighter atoms, and a tremendous amount of energy. Fissile materials include Uranium - 235, and Plutonium - 239.

To sustain a fission chain reaction at least one neutron from each split must hit another nucleus and result in a subsequent fission. Thus for a better reaction neutrons must be prevented from escaping without striking anything or being captured without a fissioning. The probability of this happening can be increased by using greater purity of fissile material, increasing the density of the material, minimizing its surface area, or surrounding it with a neutron reflector which may be made of several materials including U - 238.

The minimum critical mass necessary to sustain a chain reaction varies with the preceding four factors.

In a nuclear power reactor the fissioning is slow and controlled. In a bomb almost pure (90%+) fissile material, or so- called weapon grade material, is suddenly compacted, resulting in a super critical mass which in turn caused massive and almost instantaneous fissioning of a large fraction of the fissile material and thus the release of energy.

Two compaction methods will produce a supercritical mass. The gun method uses chemical explosives to force two subcritical hemispheres of U

- 235 together to obtain the critical mass. The implosion method uses chemical explosives to compress one subcritical mass into a super critical mass of either U - 235 or Pu - 239.

Actual bomb construction requires not only the process of manufacturing weapon grade fissile material, but also a knowledge of chemical high explosives and weapons design principles.

In constructing a hydrogen bomb (fusion), a fission bomb is used to raise the temperature high enough to cause fusion in deuterium and tritium and the attendant release of energy.

APPENDIX 3: NUCLEAR PLANTS OPERATING OR UNDER CONSTRUCTION IN DEVELOPING COUNTRIES THAT ARE OF SIGNIFICANCE TO THE SOVIET UNION*

* The data shown here is taken from the SIPRI YEARBOOK, 1986, pp 495-497, and THE ARMS CONTROL REPORTER, 1986, p 602.E.5

Unsafeguarded plants are in Italics.

Argentina
- 3 HWR power reactors
- 6 small research reactors
- 3 fuel fabrication plants
- 2 heavy water production plants (*1 unsafeguarded*)
- 1 pilot reprocessing plant
- *1 pilot enrichment plant*
- 1 uranium oxide conversion plant
- *1 UF6 plant*

Brazil
- 3 LWR power reactors
- 3 small research reactors
- 1 pilot reporcessing plant
- 1 pilot enrichment plant
- 1 fuel fabrication plant
- 1 uranium oxide conversion plant
- *1 UF6 plant*

Cuba
- 2 LWR power reactors
- 1 small LWR research reactor

India
- 10 power reactors (8 HWRs and 2 LWRs- *6 HWRs unsafeguarded*)
- *6 research reactors (includes 1 large HWR)*
- *3 reprocessing plants* (1 under safeguards while reprocessing safeguarded fuel)

2 fuel fabrication plants (1 unsafeguarded)
7 heavy water production plants
3 uranium oxide conversion plants (2 unsafeguarded)
1 thorium oxide fuel fabrication plant
1 fast breeder fuel fabrication plant

Israel — 2 research reactors (*1 large HWR*)
1 reprocessing plant
1 heavy water production plant
1 fuel fabrication plant

South Korea — 9 power reactors (8 LWRs and 1 HWR)
3 small research reactors
2 fuel fabrication plants
1 uranium oxide conversion plant

Mexico — 1 LWR power reactor
2 small research reactors

Pakistan — 1 HWR power reactor
1 small research reactor
2 reprocessing plants (possibly 3 including 2 pilot reprocessing plant)
1 pilot enrichment plant
1 fuel fabrication plant
2 HWR production plants
1 UF6 plant

Philippines — 1 LWR power reactor
1 small research reactor

South Africa — 2 LWR power reactors
1 large LWR research plant
2 enrichment plants (*1 pilot plant in operation*)
1 fuel fabrication plant
2 uranium oxide conversion plants
1 UF6 plant

Taiwan — 6 LWR power reactors

6 research reactors (including 1 HWR)
1 fuel fabrication plant
1 uranium oxide conversion plant

Each of the following countries have a single small research reactor using enriched U.S. or Soviet safeguarded fuel.

Colombia
Egypt
Iran
Iraq (destroyed)
Libya (USSR is supplying a power reactor)
Malaysia
Peru
Thailand
Uruguay
Venezuela
Viet Nam
Zaire

The following countries have two research reactors.

Chile
Indonesia
North Korea
Turkey

ENDNOTES

1. Stockholm International Peace Research Institute (SIPRI), Yearbook 1987, pp. 53-55.

2. Peter Pry, Israel's Nuclear Arsenal, pp. 1-28. In this comprehensive assessment of the current state of the Israeli nuclear weapons program, Pry contends that Israel acquired a nuclear weapon capability through US assistance and technological training. Beginning in the 1950s under the Eisenhower Administration's "Atoms for Peace" program, which was intended to alleviate energy problems of developing countries, US technical assistance and material support laid the foundation for the development of weapons in the late 1960s and early 1970s. Pry contends that the Israelis' were trained by Americans and French in weapons technology and design. He offers evidence that the large quantities of enriched uranium, believed to be between 200 and 572 pounds, discovered missing in the "Numec Affair" were channeled to Israel between 1957 and 1967 by Numec Corporation president Zalman Shapiro. Later in 1968 and 1969 in the UK and France, significant quantities of uranium were hijacked in daring daylight tear-gas attacks on government vehicles. The contents were smuggled back to Israel. In 1968 the Scheersberg-A, a ship of West German registry carrying yellowcake, "disappeared on the high seas" then reappeared weeks later under a different flag with a different name and crew. The missing uranium again reportedly ended up in Israel. By1973, the date of the Yom Kippur War, Israel reportedly had 10 atom bombs. See also The Sunday London Times, October, 1986, in which an Israeli nuclear technician, Mordechai Vanunu, revealed photographs of the plutonium manufacturing facility at Dimona. The evidence offered by Vanunu, corroborates evidence from numerous sources indicating the Israeli program in nuclear weapons production is further advanced than originally thought.

3. Sergey Kislak, "A Soviet Perspective on the Future of Non-proliferation," in The Nuclear Suppliers and Non-proliferation: International Policy Choices,

ed. by Rodney W. Jones, et al., pp 211-218. This is an excellent reference for a current statement of the USSR's policy on nuclear non-proliferation. The theme in all Soviet non-proliferation statements is strict adherence to the letter of the Nuclear Proliferation Treaty, full accountability of all nuclear materials, strict regulation of nuclear exports and peaceful uses of nuclear energy. The author enjoins all nations to adopt the provisions of the Non-proliferation because it is in the interests of all the world's nations to do so.

4. Leonard Spector, Going Nuclear. This is the third book Spector has published since 1984, on the growing nuclear proliferation threat. Each subsequent volume updates proliferation events since the proceeding book was published. Leonard's thesis in all volumes is that the nuclear non-proliferation regime of nations is not working and proliferation is steadily progressing. Spector points out that over 40 nations have not signed the Nuclear Non-proliferation Treaty and as a result, much of the effort of the non-proliferation regime is in vain. See also Leonard Spector, Nuclear Proliferation Today, for a comprehensive review of contemporary problems in stopping proliferation and, Leonard Spector, New Nuclear Nations, for a thorough rundown on the nuclear blackmarket.

5. Joseph L. Nogee, Soviet Nuclear Proliferation Policy, US Army War College Monograph, 1980, p. 20.

6. Nogee, pp. 3-8.

7. Nogee, p. 3.

8. Benjamin Lambeth, "Nuclear Proliferation and Soviet Arms Control Policy," Orbis, Summer 1975, p. 296.

9. Gloria Duffy, Soviet Nuclear Energy: Domestic and International Policies, pp.2-5; and Walter C. Clemens, The Arms Race and Sino-Soviet Relations, pp.13-30. The issue of whether the USSR gave the atom bomb to China in the 1950's has long been debated. These two authors conclude that although the Soviets probably did not actually give the Chinese a weapon, there was enough technology shared that they may as well have. The interested reader should see Clemens chapter on "A Most Puzzling Aspect of Sino-Soviet Relations" in which he describes in some detail the statements of both

governments following the break in their relations. The statements indicate that there may have been a formal agreement for the USSR to supply China with a "sample" of an atomic bomb and technical data concerning its manufacture. As the differences between the two countries widened, the USSR unilaterally tore up the agreement.

10. Duffy, pp. 2-7.

11. Duffy, p. 3.

12. SIPRI Yearbook 87, pp. 53-55.

13. Clemens, p. 31.

14. Nogee, p. 5.

15. Nogee, p. 6.

16. SIPRI, YEARBOOK 87, p. 456.

17. Gloria Duffy, "Soviet Nuclear Exports," International Security, Winter 1978, p. 6.

18. Duffy, p. 6.

19. Duffy, p. 6.

20. Joseph S. Nye, The International Nonproliferation Regime, p. 6. See also SIPRI Yearbook 1987 for current status of nonproliferation agreements, recent signatories to international arms control and weapons testing data.

21. Nye, pp. 5-8.

22. Among these agreements and treaties and the year in which they became effective include: Antartic Treaty, 1961; Partial Test Ban Treaty, 1963; Outer Space Treaty, 1967; Treaty of Tlateloco, 1968; The Nuclear Nonproliferation Treaty, 1968; The Sea Bed Treaty, 1972, and the Treaty of Rarotonga, 1986. Area specific and regional treaties have been the most effective of the means to limit nuclear proliferation. It is much simpler to get nations to agree to keep nuclear weapons out of a specific territory than

to get rid of the weapons.

23. Kislyak, p. 212.

24. Roberta Wohlstetter, The Budda Smiles: Absent-minded Peaceful Aid and the Indian Bomb, pp. 1-4. In this revealing article, Roberta Wohlstetter outlines how competition between the US, Canada and the USSR led to unsafeguarded technology and material being channeled to India. The Indian government had long wanted nuclear weapons as a security measure against their historical enemy China, which acquired the roots of its nuclear program from the USSR. Following the "peaceful bomb" incident, the US completely reversed its nuclear export policy and joined with other nuclear nations, including the USSR, in advocating the formation of the Nuclear Suppliers Group as a preventative measure from having further proliferation incidents such as this.

25. Nye, p. 8.

26. Albert Carnesdale, et al., Living with Nuclear Weapons. p. 222.

27. Kislyak, p. 213.

28. Paul F. Zinner, The Soviet Union In a Proliferated World, p. 106.

29. Nogee, p 12.

30. Pry, pp. 7-30.

31. Spector, pp. 171-175.

32. Spector, pp. 127-129.

33. Roberta Wohlstetter, "US Peaceful Aid and the Indian Bomb," in Nuclear Policies: Fuel Without the Bomb, pp. 57-61.

34. Duffy, pp. 23-24.

35. "Nuclear Powered Submarine Leased to India," Izvestiya, Morning Edition, 6 January, 1988.

36. Spector, p. 77.

37. The plutonium materials apparently came from India's Madras 1 nuclear plant. Commissioned in 1983, this completely Indian-built facility may have been designed for this specific purpose. There is speculation that China supplied the unsafeguarded heavy water used in this facility. This incident points out the problems encountered when dealing with non-signatory nations to the NPT. Although the provisions of the NPT and IAEA are working, those who have not signed the treaty are proliferating nuclear materials and technology to highly motivated countries whc can afford the expense of buying the technology. See also Judith Miller, "US is Holding Up Peking Atom Talks," New York Times, 19 September, 1982, and Gary Milhollin, "Dateline New Delhi: India's Nuclear Cover-Up," Foreign Policy, Fall 1986, p. 161.

38. Jed C. Snyder, "Preventing Nuclear Renegades: It's Too Late to Block Pakistan, But We Can Still Stop Others," New York Times, 27 September, 1987, p. D5.

39. Spector, pp. 102-121. The emergence of Pakistan as a nuclear power is an example of clandestine trade ongoing in the nuclear blackmarket. Pakistan obtained the expertise to build a bomb from agents in West Germany, Switzerland and Belgium among others. The most egerious case involved the smuggling an entire plant for converting uranium powder to uranium hexaflouride between 1977 and 1980. The products of this plant provide the fuel for the Kahuta enrichment facility. In 1985, Albrecht Migule was convicted in West Germany for masterminding the theft. Pakistan has refused to allow the plant to be placed under IAEA safeguards.

40. Fred C. Ikle' and Albert Wohlstetter, Discriminate Deterrence: Report of the Commission on Long Term Strategy, pp. 6-11.

41. Spector, pp. 68-69.

42. Spector, pp. 70-71.

43. Potter, William C., "The Soviet Union and Nuclear Proliferation," Slavic Review, pp. 481-484.

44. Potter, p. 486.

45. Spector, p. 13.

46. Nogee, p. 10.

47. Duffy, p.15.

48. Duffy, p. 15.

49. Potter, William C., "Nuclear Proliferation: U. S. - Soviet Cooperation," The Washington Quarterly, Winter 1985, pp. 141-154. It must be embarrasing for the Soviet Union to have to provide nuclear support to Cuba. This Carribbean nation has always been an outspoken critic of the Nonproliferation treaty. The Soviet Union was one of the first to adopt the treaty. That the Soviet Union is being used by the Castro regime is without question.

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7. Jones, Rodney W., et al, ed. The Nuclear Suppliers and Nonproliferation: International Policy Choices. Lexington: Lexington Books, 1985, pp. 9-15: "US Cooperative Measures for Nonproliferation," by William C. Potter.

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12. Miller, Judith. "US Is Holding Up Peking Atom Talks." New York Times, 19 September 1982, p. 1 A.

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